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HH #3  
PATENT

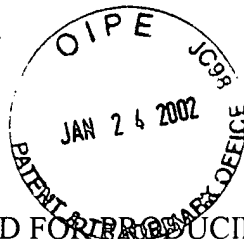
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Tung Tech Hong, et al.

Serial No.: 10/007,623

Filed: December 5, 2001

For : METHOD AND MOLD FOR PRODUCING THERMOPLASTIC RESIN  
CONTAINER



Group Art Unit: 1732

Examiner: To Be Assigned

CLAIM FOR PRIORITY

Commissioner for Patents  
Washington, D.C. 20231

Sir:

Under the provisions of 35 U.S.C. § 119, Applicants hereby claim the benefit of the filing date of Singapore Patent Appln. No. 200007203-3, filed in Singapore on December 7, 2000.

In support of this priority claim, Applicants submit herewith a certified copy of the priority application.

Respectfully submitted,

SMITH, GAMBRELL & RUSSELL, LLP

By: 

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January 24, 2002

#6

**REGISTRY OF PATENTS  
SINGAPORE**

This is to certify that the annexed is a true copy of the following Singapore patent application as filed in this Registry.

Date of Filing : 7 DECEMBER 2000

Application Number : 200007203-3


Applicant(s) : SUMITOMO BAKELITE COMPANY  
LIMITED  
SUMICARRIER SINGAPORE PTE LTD

Title of Invention : METHOD AND MOLD FOR PRODUCING  
THERMOPLASTIC RESIN CONTAINER



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Sharmaine Wu Shee Mei  
Assistant Registrar  
for REGISTRAR OF PATENTS  
SINGAPORE

**SINGAPORE  
PATENTS ACT  
(CHAPTER 221)  
PATENTS RULES**

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**0 7 DEC 2000**


*The Registrar of Patents  
Registry of Patents*

**REQUEST FOR THE GRANT OF A PATENT**  
**THE GRANT OF A PATENT IS REQUESTED BY THE UNDERSIGNED ON THE BASIS OF THE PRESENT APPLICATION**

<b>I. Title of Invention</b>	METHOD AND MOLD FOR PRODUCING THERMOPLASTIC RESIN CONTAINER	
<b>II. Applicant(s)</b> (See note 2)	<b>(a) Name</b>	Sumitomo Bakelite Company Limited
	<b>Body Description/ Residency</b>	A corporation organized under the laws of Japan
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	<b>City</b>	
	<b>State</b>	
	<b>Country</b>	Japan
	<b>(b) Name</b>	Sumicarrier Singapore Pte. Ltd.
	<b>Body Description/ Residency</b>	(a corporation organized under the laws of Singapore)
	<b>Street Name &amp; Number</b>	72 Seneko Drive, Singapore 758240
	<b>City</b>	
	<b>State</b>	
	<b>Country</b>	Singapore
	<b>(c) Name</b>	
	<b>Body Description/ Residency</b>	
	<b>Street Name &amp; Number</b>	
	<b>City</b>	
	<b>State</b>	
	<b>Country</b>	

30/27/99 88/2302 5062

III. Declaration of Priority (see note 3)	Country/Country Designated		File no.	
	Filing Date			
	Country/Country Designated		File no.	
	Filing Date			
	Country/Country Designated		File no.	
	Filing Date			
IV. Inventors (See note 4)				
(a) The applicant(s) is/are the sole/joint inventor(s).		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
(b) A statement on Patents Form 8 is furnished.		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
V. Name of Agent (if any) (See note 5)		DONALDSON & BURKINSHAW		
VI. Address for Service (See note 6)	Block/Hse No	N.A.	Level No	N.A.
	Unit No/PO Box	3667	Postal Code	905667
	Street Name		N.A.	
	Building Name		N.A.	
VII. Claiming an earlier filing date under section 20(3), 26(6) or 47(4). (See note 7)	Application No			
	Filing Date			
	[Please tick in the relevant space provided]:  ( ) Proceeding under rule 27(1)(a). Date on which the earlier application was amended = _____ Or ( ) Proceeding under rule 27(1)(b).			

VIII. Invention has been displayed at an International Exhibition (See note 8)		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
IX. Section 114 requirements (See note 9)		The invention relates to and/or used a micro-organism deposited for the purposes of disclosure in accordance with section 114 with a depository authority under the Budapest Treaty. <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
X. Check List (To be filled in by applicant or agent)	A. The application contains the following number of sheet(s):-		
	1. Request	4	sheets
	2. Description	6	sheets
	3. Claim(s).	4	sheets
	4. Drawing(s).	4	sheets
	5. Abstract.	1	sheets
	B. The application as filed is accompanied by:-		
	1. Priority document	<input type="checkbox"/>	
	2. Translation of priority document	<input type="checkbox"/>	
	3. Statement of Inventorship & right to grant	<input checked="" type="checkbox"/>	
	4. International Exhibition Certificate	<input type="checkbox"/>	
XI. Signature(s)  (See note 10)	Applicant (a)	 Donaldson & Burkinshaw for and on behalf of Sumitomo Bakelite Company Limited and Sumicarrier Singapore Pte. Ltd.	
	Date	6 December 2000	
	Applicant (b)		
	Date		
	Applicant (c)		
	Date		

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## NOTES:

1. This form when completed, should be brought or sent to the Registry of Patents together with the prescribed fee and 3 copies of the description of the invention, and of any drawings.
2. Enter the name and address of each applicant in the spaces provided at paragraph II. Names of individuals should be indicated in full and the surname or family name should be underlined. The names of all partners in a firm must be given in full. The place of residence of each individual should also be furnished in the space provided. Bodies corporate should be designated by their corporate name and country of incorporation and, where appropriate, the state of incorporation within that country should be entered where provided. Where more than 3 applicants are to be named, the names and address of the fourth and any further applicants should be given on a separate sheet attached to this form together with the signature of each of these further applicants.
3. The declaration of priority at paragraph III should state the date of the previous filing, the country in which it was made, and indicate the file number, if available. Where the application relied upon in an International Application or a regional patent application e.g. European patent application, one of the countries designated in that application [being one falling under the Patents (Convention Countries) Order] should be identified and the name of that country should be entered in the space provided.
4. Where the applicant or applicants is/are the sole inventor or the joint inventors, paragraph IV should be completed by marking the 'YES' Box in the declaration (a) and the 'NO' Box in the alternative statement (b). Where this is not the case, the 'NO' Box in declaration (a) should be marked and a statement will be required to be filed on Patents Form 8.
5. If the applicant has appointed an agent to act on his behalf, the agent's name should be indicated in the spaces available at paragraph V.
6. An address for service in Singapore to which all documents may be sent must be stated at paragraph VI. It is recommended that a telephone number be provided if an agent is not appointed.
7. When an application is made by virtue of section 20(3), 26(6) or 47(4), the appropriate section should be identified at paragraph VII and the number of the earlier application or any patent granted thereon identified. Applicants proceeding under section 26(6) should identify which provision in rule 27 they are proceeding under. If the applicants are proceeding under rule 27(1)(a), they should also indicate the date on which the earlier application was amended.
8. Where the applicant wishes an earlier disclosure of the invention by him at an International Exhibition to be disregarded in accordance with section 14(4)(c), then the 'YES' Box at paragraph VIII should be marked. Otherwise the 'NO' Box should be marked.
9. Where in disclosing the invention the application refers to one or more micro-organisms deposited with a depository authority under the Budapest Treaty, then the 'YES' Box at paragraph IX should be marked. Otherwise the 'NO' Box should be marked.
10. Attention is drawn to rules 90 and 105 of the Patent Rules. Where there are more than 3 applicants, see also Note 2 above.
11. Applicants resident in Singapore are reminded that if the Registry of Patents considers that an application contains information the publication of which might be prejudicial to the defence of Singapore or the safety of the public, it may prohibit or restrict its publication or communication. Any person resident in Singapore and wishing to apply for patent protection in other countries must first obtain permission from the Singapore Registry of Patents unless they have already applied for a patent for the same invention in Singapore. In the latter case, no application should be made overseas until at least 2 months after the application has been filed in Singapore.

## For Official Use

Application Filing Date:        /        /

Request received on        :        /        /

Fee received on        :        /        /

Amount        :

\*Cash/Cheque/Money Order No:

*\*Delete whichever is inapplicable*

SINGAPORE PATENT OFFICE

- 1 -

## METHOD AND MOLD FOR PRODUCING THERMOPLASTIC RESIN CONTAINER

## BACKGROUND OF THE INVENTION AND RELATED ART STATEMENT

The present invention relates to a method and mold for producing a thermoplastic resin container, particularly usable as a thermoplastic resin tape-shaped carrier having recesses for containing  
5 respectively electric elements such as integrated circuit chips.

In the prior art, a recess of a thermoplastic resin container for containing an element is formed by  
10 urging pneumatically a part of a thermoplastic resin sheet into a cavity of a mold.

## OBJECT AND SUMMARY OF THE INVENTION

An object of the present invention is to provide a method and mold for producing a thermoplastic  
15 resin container, by which method and mold a flatness at a bottom of a recess of the thermoplastic resin container is improved.

According to the present invention, a method for producing a thermoplastic resin container including  
20 a base portion, a pair of side walls extending from the planar base, and a bottom portion extending between the side walls with a distance between the base portion and the bottom portion in a thickness direction of the bottom portion so that a recess for containing an

element is formed, comprises the step of urging a part of a thermoplastic resin sheet into a cavity of a mold after heating the part of the thermoplastic resin sheet, so that the bottom portion and the side walls are  
5 formed with the distance, wherein a bottom of the cavity has a convex shape area protruding in a depth direction away from the base portion formed on another part of the thermoplastic resin sheet on the mold.

According to the present invention, a mold  
10 for producing, from a thermoplastic resin sheet, a container including a base portion, a pair of side walls extending from the planar base, and a bottom portion extending between the side walls with a distance between the base portion and the bottom  
15 portion in a thickness direction of the bottom portion, comprises a cavity adapted to receive a part of the thermoplastic resin sheet after heating the part of the thermoplastic resin sheet, so that the bottom portion and the side walls are formed in the cavity with the  
20 distance so that a recess of the container for receiving therein an element is formed, and a planar base area being adjacent to the cavity and surrounding the cavity, wherein a bottom of the cavity has a convex shape area protruding in a depth direction away from  
25 the planar base area.

Since the bottom of the cavity has the convex shape area protruding in the depth direction away from the base portion formed on the another part of the



thermoplastic resin sheet surrounding the recess, a flatness at the bottom portion after the thermoplastic resin container is cooled to an atmospheric temperature is improved in spite of thermal stress and/or deformation of the thermoplastic resin sheet after the thermoplastic resin sheet is deformed to form the container.

When a depth of the cavity in the depth direction is larger than the distance, the bottom portion is restrained from being protruding in a direction opposite to the depth direction so that the flatness at the bottom portion after the thermoplastic resin container is cooled to the atmospheric temperature is improved. It is preferable that the convex shape is a dome shape, truncated conical shape or truncated pyramid shape. A main area of the bottom portion may extend substantially parallel to the base portion. It is preferable for improving the flatness that a difference in depth between a top of the convex shape and a base thereof in the direction away from the planar base portion is 0.1 - 1 mm. The thermoplastic resin container may be adapted to contain a ball grid array electric element.

When the distance is decreased to become less than the depth of the cavity after the distance becomes equal to the depth of the cavity and/or when the distance is decreased after the bottom portion contacts with the bottom of the cavity, the flatness is

effectively improved. When the bottom of the cavity has a planar area being adjacent to the convex shape area and surrounding the convex shape area and/or the convex shape area has a planar area at a top thereof, the flatness is further improved.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an oblique projection view showing a container (element carrier tape) of the invention.

Fig. 2 is a side view showing the container.

Fig. 3 is a cross-sectional view taken along III-III face in Fig. 1.

Fig. 4 is a cross-sectional view showing the container receiving therein an electric element such as ball grid array electric element.

Fig. 5a is an oblique projection view showing another container (element carrier tape) of the invention.

Fig. 5b is a side view showing the container of Fig. 5a.

Fig. 5c is a cross-sectional view taken along Vc-Vc face in Fig. 5a.

Fig. 6a is an oblique projection view showing a mold of the invention.

Fig. 6b is a cross sectional view taken along VIb- VIb face in Fig. 6a.

#### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

As shown in Fig. 1, a container 1 used as a carrier tape for an electric element such as SOP (small outline package), SSOP (shrink small outline package), TSOP (thin small outline package), TSSOP (thin shrink small outline package), PLCC (plastic leaded chip carrier), QFP (quad flat package), BGA (ball grid array) or the like and made of a flexible resin has recesses (embossed areas) 2 including the claimed side walls and bottom portion, and a flange 3 as the claimed base portion. The recesses 2 are aligned along a longitudinal direction of the carrier tape with a constant interval and can receive therein respective electric elements. A tape-shaped cover (not shown) is adhered to the flange 3 to cover the recesses so that the electric elements are prevented from being removed from the recesses, and tape feeding holes 4 are arranged along the longitudinal direction at at least one of sides of the flanges. The recesses 2 are formed by urging pneumatically (with pressure difference by vacuuming or pressurizing air) parts of a thermoplastic resin sheet into respective cavities of a mold.

When the cavity of the mold has an area of 27 mm × 27 mm and a depth of 3 mm, a bottom of the cavity has at a center thereof a truncated quadrangular pyramid convex shape dent of 0.3 mm height with a top planar area of 26 mm × 26 mm, and a polystyrene sheet of 0.3 mm thickness is urged pneumatically into the cavity after being heated to 180°C so that the recess

is formed,

$K_o = 3.05 \text{ mm}$ ,  $K_c = 3.10 \text{ mm}$ ,  $P_o = 0.28 \text{ mm}$ , and  
 $P_c = 0.20 \text{ mm}$ , while  $K_o$  is a depth of the recess at a  
center thereof between an upper surface of the flange 3  
5 and the center thereof,  $K_c$  is a depth of the recess at  
a periphery thereof between the upper surface of the  
flange 3 and the periphery thereof,  $P_o$  is a thickness  
of the sheet at the center thereof, and  $P_c$  is a  
thickness of the sheet at the periphery thereof.

10             $A \text{ warp } W = (K_c + P_c) - (K_o + P_o) = -0.03 \text{ mm}$   
             Therefore, the warp  $W$  is significantly small.  
             When the recess receives therein a BGA  
package,

$Z_o = 0.45 \text{ mm}$ , and  $Z_c = 0.5 \text{ mm}$ , while  $Z_o$  is a  
15 difference between a height of the BGA package received  
in the recess and the depth of the recess at the center  
of the recess, and  $Z_c$  is a difference between the  
height of the BGA package and the depth of the recess  
at the periphery of the recess.

20            When the truncated quadrangular pyramid  
convex shape dent is not included by the cavity of the  
mold as described above,

$K_o = 2.75 \text{ mm}$ ,  $K_c = 3.10 \text{ mm}$ ,  $P_o = 0.28 \text{ mm}$ ,  $P_c$   
 $= 0.20 \text{ mm}$ ,  $W = (K_c + P_c) - (K_o + P_o) = 0.27 \text{ mm}$ ,  $Z_o =$   
25  $0.15 \text{ mm}$ , and  $Z_c = 0.5 \text{ mm}$ .

Therefore,  $Z_o$  is significantly small so that  
the BGA package may be easily damaged.

WHAT IS CLAIMED IS :

1. A method for producing a thermoplastic resin container including a base portion, side walls extending from the planar base, and a bottom portion extending between the side walls with a distance between the base portion and the bottom portion in a thickness direction of the bottom portion, comprising the step of:

urging a part of a thermoplastic resin sheet into a cavity of a mold after heating the part of the thermoplastic resin sheet, so that the bottom portion and the side walls are formed with the distance,

wherein a bottom of the cavity has a convex shape area protruding in a depth direction away from the base portion formed on another part of the thermoplastic resin sheet on the mold.

2. A method according to claim 1, wherein a depth of the cavity in the depth direction is larger than the distance.

3. A method according to claim 1, wherein the convex shape is a truncated conical shape or truncated pyramid shape.

4. A method according to claim 1, wherein a main area of the bottom portion extends substantially parallel to the base portion.

5. A method according to claim 1, wherein a difference in depth between a top of the convex shape

and a base thereof in the depth direction away from the base portion is 0.1 - 1 mm.

6. A method according to claim 1, wherein the thermoplastic resin container is adapted to contain a ball grid array electric element.

7. A method according to claim 1, wherein the distance is decreased to become less than the depth of the cavity after the distance becomes equal to the depth of the cavity.

8. A method according to claim 1, wherein the distance is decreased after the bottom portion contacts with the bottom of the cavity.

9. A method according to claim 1, wherein the bottom of the cavity has an annular planar area being adjacent to the convex shape area and surrounding the convex shape area.

10. A method according to claim 1, wherein the convex shape area has a planar area at a top thereof.

11. A mold for producing, from a thermoplastic resin sheet, a container including a base portion, side walls extending from the planar base, and a bottom portion extending between the side walls with a distance between the base portion and the bottom portion in a thickness direction of the bottom portion, comprising :

a cavity adapted to receive a part of the thermoplastic resin sheet after heating the part of the thermoplastic resin sheet, so that the bottom portion

and the side walls are formed in the cavity with the distance, and

a planar base area being adjacent to the cavity and surrounding the cavity,

wherein a bottom of the cavity has a convex shape area protruding in a depth direction away from the planar base area.

12. A mold according to claim 11, wherein a depth of the cavity in the depth direction is larger than the distance.

13. A mold according to claim 11, wherein the convex shape is a truncated conical shape or truncated pyramid shape.

14. A mold according to claim 11, wherein a main area of the bottom portion extends substantially parallel to the base portion.

15. A mold according to claim 11, wherein a difference in depth between a top of the convex shape and a base thereof in the direction away from the planar base portion is 0.1 - 1 mm.

16. A mold according to claim 11, wherein the thermoplastic resin container is adapted to contain a ball grid array electric element.

17. A mold according to claim 11, wherein the mold allows the distance to be decreased to become less than the depth of the cavity after the distance becomes equal to the depth of the cavity.

18. A mold according to claim 11, wherein the

mold allows the distance to be decreased after the bottom portion contacts with the bottom of the cavity.

19. A mold according to claim 11, wherein the bottom of the cavity has an annular planar area being adjacent to the convex shape area and surrounding the convex shape area.

20. A mold according to claim 11, wherein the convex shape area has a planar area at a top thereof.



ABSTRACT OF THE DISCLOSURE

METHOD AND MOLD FOR PRODUCING THERMOPLASTIC RESIN CONTAINER

A recess of a thermoplastic resin container is formed by urging a part of a thermoplastic resin sheet into a cavity of a mold after heating the part of the thermoplastic resin sheet, so that a bottom portion and side walls of the recess are formed, wherein a bottom of the cavity has a convex shape area protruding in a depth direction away from the base portion formed on another part of the thermoplastic resin on the mold.

Fig. 6a

FIG.1

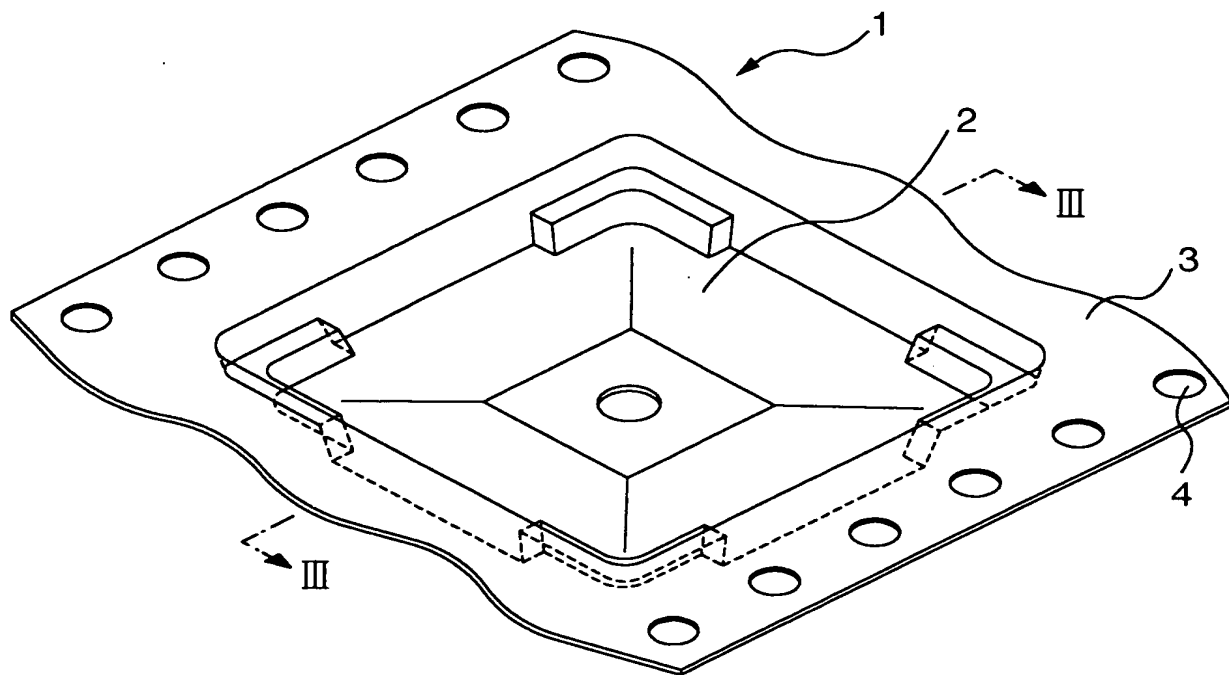


FIG.2

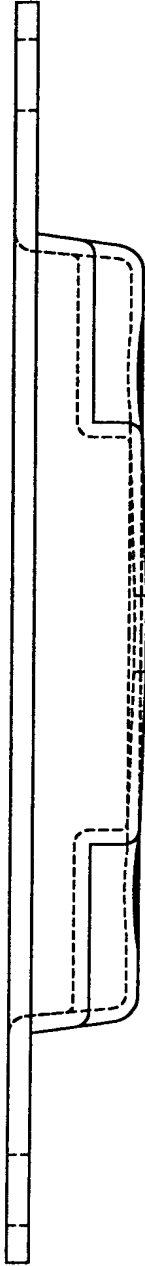


FIG.3

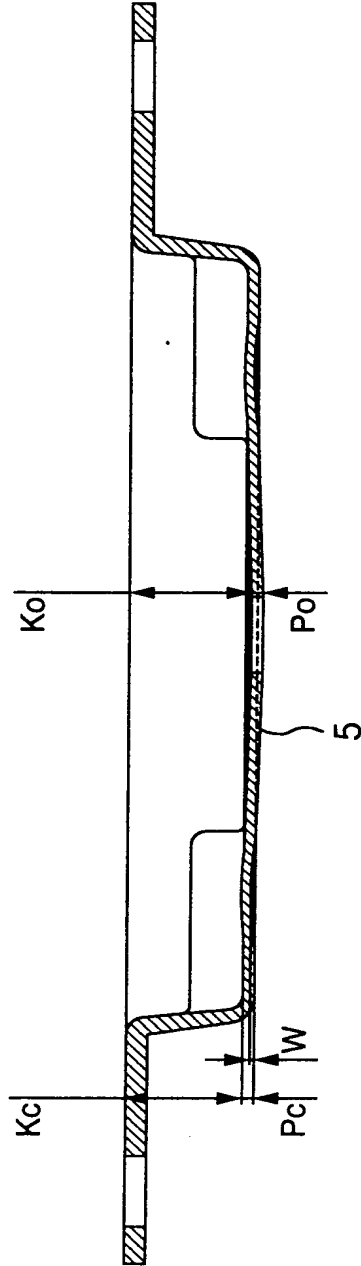


FIG.4

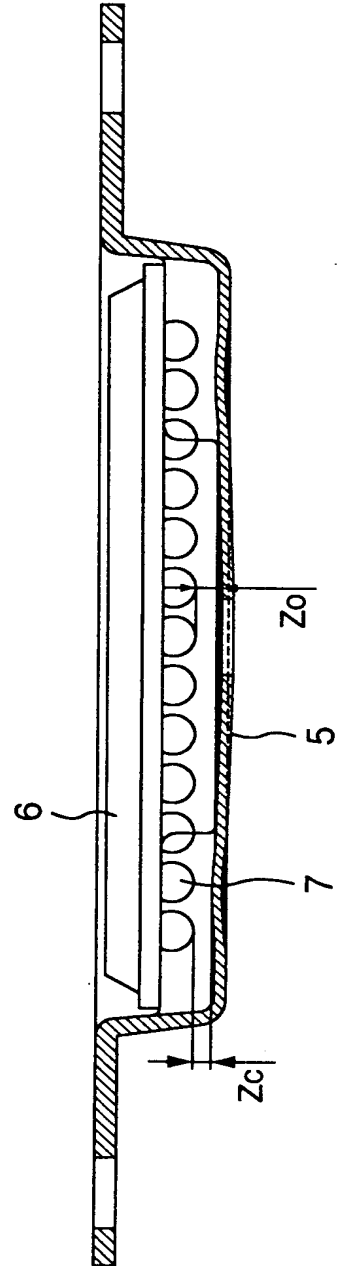


FIG.5a

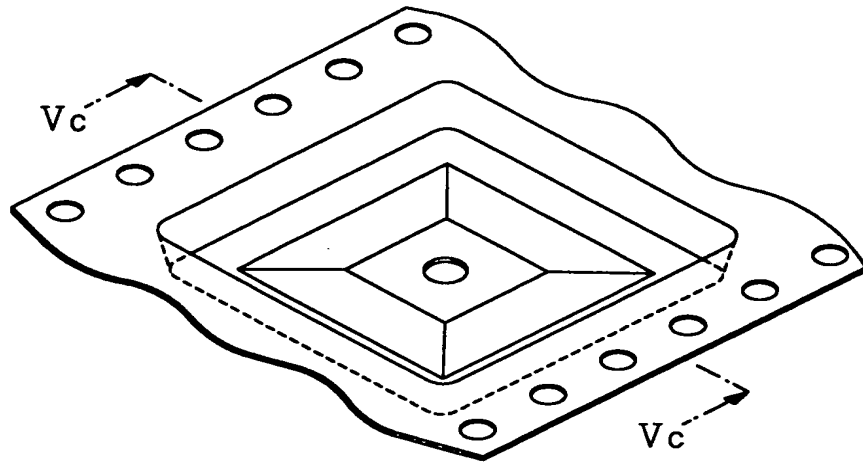


FIG.5b

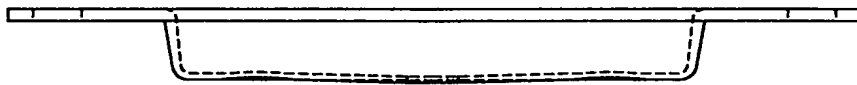


FIG.5c

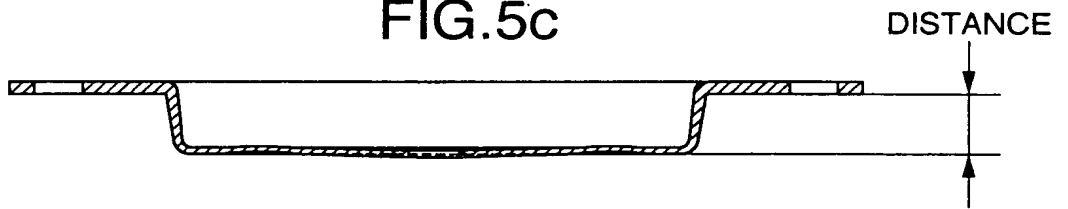


FIG.6a

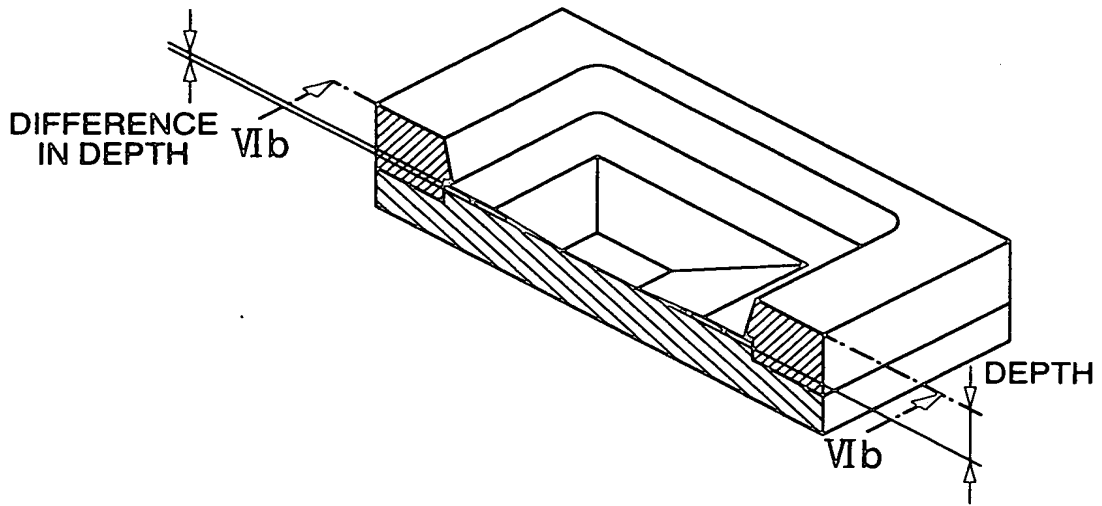


FIG.6b

